

**WHAT IS CLAIMED IS:**

1. A wavelength-division-multiplexed optical source comprising:
  - a pump laser;
  - 5 a first optical amplifier, operated by rear-pumping of the pump laser, for generating amplified spontaneous emission noise (ASE noise);
  - a first multiplexer/demultiplexer having a first input/output terminal on one side and a plurality of second input/output terminals on the other side, for demultiplexing signals inputted into the first input/output terminal and outputting the demultiplexed signals
  - 10 to the second input/output terminals, and for multiplexing signals inputted into the second input/output terminals and outputting the multiplexed signals to the first input/output terminal;
  - a plurality of mirrors, connected to the second input/output terminals in one-to-one correspondence, for inputting again the demultiplexed signals outputted through the second
  - 15 input/output terminals;
  - a circulator for transmitting signals inputted from the first optical amplifier to the first input/output terminal, and for outputting multiplexed signals inputted from the first input/output terminal;
  - a second optical amplifier, operated by rear-pumping of the pump laser, for
  - 20 amplifying multiplexed signals outputted from the circulator;
  - an optical splitter for splitting the multiplexed signals amplified by the second optical amplifier and for outputting the split signals to the first optical amplifier and for external transmission, respectively; and

an external modulator for modulating the signals outputted for external transmission according to preset broadcasting signals and for outputting the modulated signals to a transmission link.

5           2. A wavelength-division-multiplexed optical source as claimed in claim 1, wherein the optical source further comprises a band-pass filter for outputting the multiplexed signals inputted from the circulator to the second optical amplifier, after having limited the multiplexed signal to a preset wavelength band of the wavelength-division-multiplexed optical source.

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3. A wavelength-division-multiplexed optical source as claimed in claim 1, wherein the first optical amplifier amplifies signals inputted from the optical splitter and outputs the amplified signals to the circulator.

15           4. A wavelength-division-multiplexed optical source as claimed in claim 1 or claim 3, wherein the first optical amplifier comprises an erbium-doped fiber amplifier.

5. A wavelength-division-multiplexed optical source as claimed in claim 1, wherein the first optical amplifier comprises a semiconductor optical amplifier.

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6. A wavelength-division-multiplexed optical source as claimed in claim 1, wherein the multiplexer/demultiplexer comprises a  $1 \times N$  waveguide grating router (WGR).

7. A wavelength-division-multiplexed optical source as claimed in claim 1,  
wherein the second optical amplifier comprises an erbium-doped fiber amplifier.

5        8. A wavelength-division-multiplexed optical source as claimed in claim 1,  
wherein the second optical amplifier comprises a semiconductor optical amplifier.

9. A wavelength-division-multiplexed optical source as claimed in claim 1,  
wherein the external modulator comprises an LiNbO<sub>3</sub> modulator.

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10. A wavelength-division-multiplexed optical source as claimed in claim 1,  
wherein the external modulator comprises an electro-absorption modulator.

11. A wavelength-division-multiplexed optical source as claimed in claim 1,  
15 wherein the external modulator comprises a semiconductor optical amplifier.

12. A passive optical network system including a central office, a local office, and  
a plurality of subscriber terminals, the central office being connected with a local office  
through an optical fiber and providing optical communication service to the subscriber  
20 terminals through the local office, the central office comprising:

a first wavelength-division-multiplexed (WDM) optical source for providing a  
downstream broadcasting service to the subscriber terminals;

a second WDM optical source for providing a downstream data service to the

subscriber terminals;

a plurality of optical receivers for receiving upstream data service signals transmitted from the subscriber terminals and converting the received signals to electric signals;

5 a plurality of first wavelength division multiplexers for multiplexing/demultiplexing upstream/downstream data service signals to provide upstream/downstream data services to the subscriber terminals;

a second multiplexer/demultiplexer for multiplexing a plurality of downstream data service signals outputted from the first wavelength division multiplexers, and for  
10 demultiplexing upstream data service signals to be transmitted to the first wavelength division multiplexers; and

a second wavelength division multiplexer for multiplexing the multiplexed signals inputted from said second multiplexer/demultiplexer and the multiplexed signals inputted from the first WDM optical source, for demultiplexing upstream data service signals  
15 inputted from the local office and outputting the demultiplexed signals to said second multiplexer/demultiplexer.

20 13. A passive optical network system as claimed in claim 12, wherein the first WDM optical source in the central office is the wavelength-division-multiplexed optical source of claim 1.

14. A passive optical network system as claimed in claim 13, wherein said second multiplexer/demultiplexer is a  $1 \times N$  waveguide grating router (WGR).

15. A passive optical network system as claimed in claim 13, wherein the first  
5 WDM optical source in the central office further comprises a first band-pass filter for limiting the multiplexed signal inputted from the circulator to a preset wavelength band-pass of the first WDM optical source.

16. A passive optical network system as claimed in claim 15, wherein the second  
10 WDM optical source in the central office comprises a second band-pass filter for limiting a band-pass of the second WDM optical source to one that differs from the band-pass of the first band-pass filter.

17. A passive optical network system as claimed in claim 16, wherein the second  
15 band-pass filter has the same band-pass as a free spectrum range (FSR) of said second multiplexer/demultiplexer and has a center wavelength separated more than a FSR from a center wavelength of the first band-pass filter.

18. A passive optical network system as claimed in claim 12, wherein the first wavelength division multiplexer comprises:

20 a third band-pass filter having the same band-pass as a preset wavelength band of the second WDM optical source; and

a fourth band-pass filter having the same band-pass as a wavelength band of an upstream optical source in the subscriber terminal.

19. A passive optical network system as claimed in claim 12, wherein the second wavelength division multiplexer comprises:

a fifth band-pass filter having the same band-pass as a wavelength band of WDM  
5 optical signals for upstream/downstream data services; and

a sixth band-pass filter having the same band-pass as a preset wavelength band of the first WDM optical source.

20. A passive optical network system as claimed in claim 12, wherein said second  
10 multiplexer/demultiplexer is a  $1 \times N$  waveguide grating router (WGR).

21. A passive optical network system as claimed in claim 12, wherein the second wavelength division multiplexer further comprises an optical amplifier for amplifying downstream signals outputted from said second multiplexer/demultiplexer and upstream  
15 signals inputted into the second wavelength division multiplexer.

22. A passive optical network system as claimed in claim 21, wherein the optical amplifier is an erbium-doped fiber amplifier.

20 23. A passive optical network system including a central office, a local office, and a plurality of subscriber terminals, the local office being connected to the central office and the subscriber terminals through optical fibers and providing optical communication service to the subscriber terminals, the local office comprising a multiplexer/demultiplexer for

demultiplexing optical signals for downstream data service and optical signals for downstream broadcasting service multiplexed and transmitted from the central office 100, and for multiplexing upstream optical signals transmitted from the subscriber terminals.

5           24. A passive optical network system as claimed in claim 23, wherein the multiplexer/demultiplexer is a  $1 \times N$  waveguide grating router (WGR).

          25. A passive optical network system including a central office, a local office, and a plurality of subscriber terminals connected to the central office through the local office by  
10 optical fibers and being provided optical communication service provided from the central office, a subscriber terminal of said plurality comprising:

          a wavelength division multiplexer for demultiplexing optical signals transmitted downstream from the local office and dividing optical signals for downstream data service and optical signals for downstream broadcasting service and outputting the divided optical  
15 signals, and for multiplexing optical signals for upstream transmission from said subscriber terminal to the local office;

          a downstream data receiver for receiving optical signals for downstream data service demultiplexed by the wavelength division multiplexer and converting the received optical signals to electric signals;

20           a downstream broadcasting receiver for receiving optical signals for downstream broadcasting service demultiplexed by the wavelength division multiplexer and converting the received optical signals to electric signals; and

          an upstream optical source for generating optical signals for upstream transmission

to the local office through the wavelength division multiplexer.

26. A passive optical network system as claimed in claim 25, wherein the upstream optical source further comprises a band-pass filter for limiting a wavelength band of the upstream optical source so as to differ from wavelength bands of the optical signals for the downstream data service and so as to differ from wavelength bands of the optical signals for the downstream broadcasting service.

27. A passive optical network system as claimed in claim 26, wherein the wavelength division multiplexer comprises:

a first band-pass filter for passing the wavelength band of the upstream optical source;

a second band-pass filter for passing optical signals for downstream data service;

and

a third band-pass filter for passing the optical signals for downstream broadcasting service.